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Authors will be furnished, gratis, with 20 reprints of each article published in the Journal, if application for the same be made when the article is sent.

Members are requested to give notice of any change of address, or failure in the delivery of the Journal. All communications relating to the Journal should be addressed to the Editor.

A. A. BRENEMAN, 97 Water St., New York.

The regular meeting was called for June 7th, 1889.

No quorum.

An informal meeting was held. The secretary announced the receipt of a letter from Kékulé acknowledging the notification of his election to honorary membership.

The following papers were read by Dr. L. H. Friedburg:

1. The reaction of hydrogen peroxide with potassium permanganate, in presence of sulphuric acid. By A. Bourgougnon.

2. Some general considerations on Isomerism (second paper),* by Dr. L. H. Friedburg.

Discussion followed.

DURAND WOODMAN, Rec. Sec'y.

* Withdrawn by the author for correction and extension.

ON THE REACTION OF HYDROGEN PEROXIDE WITH POTASSIUM PERMANGANATE IN PRESENCE OF SULPHURIC ACID.

By A. Bourgougnon.

Brodie (Phil. Trans., 1850, **2**, 779) investigated the action of hydrogen dioxide upon potassium permanganate in the presence of sulphuric acid, and found that this reaction required three molecules of H_2O_2, whilst other chemists assert that the reaction takes place with five molecules of H_2O_2. In either case, correct equations are obtained.

$2\,K\,Mn\,O_4 + 3\,H_2\,SO_4 + 3\,H_2O_2 = K_2\,SO_4 + 2\,Mn\,SO_4 + 6\,H_2O + 8O$

$2\,K\,Mn\,O_4 + 3\,H_2\,SO_4 + 5\,H_2\,O_2 = K_2\,SO_4 + 2\,Mn\,SO_4 + 8\,H_2O + 10\,O.$

This anomaly can be explained in the following way:

Let us write again the preceding equation without giving any determinate coefficient to the substances employed and obtained in the reaction, in fact, writing this equation in the most indeterminate way.

$$a\,K\,Mn\,O_4 + b\,H_2SO_4 + cH_2O_2,$$

giving $$x\,K_2\,SO_4 + y\,Mn\,SO_4 + z\,H_2\,O + t\,O.$$

The products employed for the reaction will give:

For $a\,K\,Mn\,O_4$.	For $b\,H_2\,SO_4$.	For $c\,H_2O_2$.
$K = a.$	$H = 2b.$	$H = 2c.$
$Mn = a.$	$S = b.$	$O = 2c.$
$O = 4a.$	$O = 4b.$	

And the products of the reaction

For $x\,K_2\,SO_4$.	For $y\,Mn\,SO_4$.	For $z\,H_2\,O$.	For $t\,O$.
$K = 2x.$	$Mn = y.$	$H = 2\,z.$	$O = t.$
$S = x.$	$S = y.$	$O = z.$	
$O = 4x.$	$O = 4y.$		

Giving the following equations:

$$a = 2x.$$
$$b = x + y.$$
$$4a + 4b + 2c = 4x + 4y + t + z \quad \text{----------(3)}$$
$$a = y$$
$$2b + 2c = 2z,$$

from which

$$x = \frac{a}{2},\ y = a,\ b = x + y = \frac{3a}{2},\ z = b + c.$$

Substituting the values of b, x, y, z in equation (3), gives

$$4a + \frac{12a}{2} + 2c = 2a + 4a + t + b + c,$$

or

$$\frac{8a}{2} + 6a + 2c = 6a + \frac{3a}{2} + t + c.$$

and

$$\frac{8a}{2} - \frac{3a}{2} = t + c - 2c = t - c.$$

$$c = t - \frac{5a}{2}.$$

We have also

$$z = b + c = \frac{3a}{2} + t - \frac{5a}{2} = t - a.$$

Finally we obtain the following values:

$$x = \frac{a}{2},\ y = a,\ b = \frac{3a}{2},\ c = t - \frac{5a}{2},\ z = t - a.$$

As these results represent whole numbers, it is evident that the smallest value which can be given to a is 2, because

$$\frac{3a}{2} \text{ and } \frac{5a}{2}$$

represent whole numbers.

Taking $a = 2$, the other values become

$$a = 2,\ x = 1,\ y = 2,\ b = 3,\ c = t - 5,\ z = t - 2.$$

But c and z are whole and positive numbers, then necessarily t is greater than 5, otherwise $t - 5$ and $t - 2$ would be negative. As we must have $t > 5$, t must be then equal to all the whole numbers, beginning with 6.

Then

$$\left.\begin{array}{l} x = 1. \\ y = 2. \\ b = 3. \\ a = 2. \\ c = 1, 2, 3, 4, 5, 6 \text{ ----} \\ z = 4, 5, 6, 7, 8, 9, 10 \text{ -} \\ t = 6, 7, 8, 9, 10, 11 \text{ --} \end{array}\right\} \textit{ad infinitum.}$$

If, now, we replace the indeterminate quantities used in the original equation by their values we have

$$2\,K\,Mn\,O_4 + 3H_2SO_4 + H_2O_2 = K_2SO_4 + 2\,Mn\,SO_4 + 4\,H_2O + 6O.$$

If, keeping $x = 1$, $y = 2$, $b = 3$, $a = 2$, we take the second values of c, z and t, we have

$$2\,K\,Mn\,O_4 + 3\,H_2SO_4 + 2H_2O_2 = K_2SO_4 + 2\,Mn\,SO_4 + 5\,H_2O + 7O$$

and so on, from which we deduce the following simple relation:

$$\left.\begin{array}{l} \text{Taking a of } K\,Mn\,O_4 \\ \text{“ b of } H_2SO_4 \end{array}\right\} \text{constant.}$$
$$\text{and c of } H_2O_2 \qquad \text{variable}$$

we obtain a quantity, t, of free oxygen depending upon the quantity c, (H_2O_2) employed, which as in weight t, oxygen liberated, is equal to c; quantity of H_2O_2 used in the reaction, *plus 5*.

The study of this reaction shows that this result belongs to the class of indeterminate problems and consequently an infinity of solutions may be obtained, but only in certain positive relations once determined. The quantity x (K_2SO_4) and y ($Mn\,SO_4$) are dependent upon a ($KMn\,O_4$) and b (H_2SO_4), and for these quantities the amount of H_2O_2 to be taken may vary from the minimum, $c = 1$ and for this, corresponding values for t and z are obtained.

If potassium dichromate is substituted for potassium permanganate, analogous results are obtained: the final products of the reaction will be potassium sulphate, chromium sulphate, water and oxygen.

We have

$$a\,K_2Cr_2O_7 + b\,H_2SO_4 + c\,H_2O_2,$$
$$\text{giving } x\,K_2SO_4 + y\,Cr_2(SO_4)_3 + z\,H_2O + t\,O,$$

from which we obtain

$$2a = 2x.$$
$$2a = 2y.$$
$$7a + 4b + 2c = 4x + 12y + z + t \text{------(3).}$$
$$2b + 2c = 2z \text{----------(4).}$$
$$b = x + 3y.$$

giving the following values

$$a = x,\ x = y,\ z = b + c,\ b = 4a,\ a = \frac{b}{4}$$

Substituting the values of b and y in equation (3) gives

$$7a + 16a + 2c = 4a + 12a + z + t,$$

reducing and subtracting equation (4) we have

$$3a + c = t.$$
$$c = t - 3a.$$

But t being a whole and positive number we must have

$$t > 3a.$$

Equation (4) gives

$$b + c = 2z.$$
$$4a + c = z$$
$$c = z - 4a,$$

and

$$z > 4a.$$

We have then the following values:

$$a = x,\ x = y,\ z = b + c,\ b = 4a,\ a = \frac{b}{4}$$

Giving to b its smallest value, 4, we find

$$a = 1$$
$$b = 4$$
$$x = 1$$
$$y = 1$$
$$\left.\begin{array}{l} c = 1, 2, 3, 4, 5, 6\text{----} \\ t = 4, 5, 6, 7, 8, 9\text{----} \\ z = 5, 6, 7, 8, 9, 10\text{----} \end{array}\right\} \textit{ad infinitum.}$$

Introducing these values in the original equation, gives

$$K_2Cr_2O_7 + 4\,H_2SO_4 + H_2O_2 = K_2SO_4 + Cr_2(SO_4)_3 + 5H_2O + 4O$$

The other values of c, t and z will give

$K_2Cr_2O_7 + 4\,H_2SO_4 + 2\,H_2O_2 = K_2SO_4 + Cr_2(SO_4)_3 + 6H_2O + 5O$
$K_2Cr_2O_7 + 4\,H_2SO_4 + 3\,H_2O_2 = K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 6O$

and so on, from which we deduct the following simple relation:

Taking a of $K_2Cr_2O_7$ } constant,
" b " H_2SO_4 }
and c " H_2O_2 variable,

we obtain a quantity, t, of free oxygen depending upon the quantity c, (H_2O_2) employed, such as in weight t, oxygen liberated is equal to c, quantity of H_2O_2 used in the reaction, *plus 3*.

College of the City of New York, June, 1889.

NOTE ON LEAD POISONING BY CARBONATED BEVERAGES.

By Durand Woodman.

In the Summer months of last year (1888) there was an unusual number of cases of lead poisoning in the hospitals of Newark, N. J., the greater part of which were unaccountable, so far as occupation of those suffering was concerned.

In several cases suspicion was strongly directed to bottled beer, soda water and other bottled carbonated beverages, and attention was particularly directed to the patent combination rubber and metal stopper, consisting of a rubber washer held in place by a metal disc.

Qualitative examination proved this disc to be an alloy of lead and tin. Evidences of corrosion were also visible, a gray crust of greater or less depth, according to length of time the stopper had been in use, indicating action of the carbonated liquid on the alloy. Analysis of the alloy gave

Lead	46.0
Tin	53.2
	99.2

which corresponds closely with the composition of common solder.

Dr. Herold, of Newark, in a report to the Board of Health, stated that he found two grades of stoppers, one containing lead, 42.4 per cent., practically corresponding to the above analysis, and another containing 83.6 per cent lead, corresponding to common pewter.

In unconcentrated samples of sarsaparilla beer, ginger ale and soda water, when not too highly colored, hydrogen sulphide produced a reaction varying from a mere darkening of the fluid to a distinct precipitate.

The quantities of lead, and in some cases also, of tin, were determined in several samples by evaporating igniting to ash, treating with nitric acid and evaporating, to insure conversion of tin to oxide, then taking up by dilute hydrochloric acid, precipi-

tating by hydrogen sulphide and determining as sulphate in the usual manner.

The quantities found are given in the following tabular statement:

				Lead.	Grains per Gallon.	
No.		Brand.	Quantity used.	Milligrams found.	Lead.	Tin.
437	Soda Water.	I C V	250 c. c.	3.	0.63	---
438	" "	"	250 c. c.	2.	0.46	1.4
439	Ginger Ale.	C S	----------	--	----	---
440	Soda Water.	O B	675 c. c.	3.7	0.33	---
442	" "	V S M H	1800 c. c.	47.0	1.52	1.63

The last sample, No. 442, was a mixture of several different brands, and the bottles were kept a week lying on their sides before opening them.

It will be observed that more tin has been dissolved than lead. Proust is authority for the statement that from an alloy of lead 75, tin 25, vinegar dissolves tin only. (Watts III., 535.) A small amount of copper, not determined, was also found in No. 442, probably from some vessel or pipe at the bottling establishments.

In considering these figures, it is to be taken into account that ordinary bottled soda water is flavored with lemon, perhaps reinforced by citric acid, which would be another factor in the solvent action due to the carbonated liquid.

In experiments made with carbonated water alone, Dr. Herold reported finding 0.52 grain of lead per gallon after only two days' contact with the stoppers, under the same conditions of pressure.

Of a number of samples recently examined from bottles closed by ordinary corks, several have responded slightly to hydrogen sulphide, indicating, as above mentioned, that a part of the dissolved metals has its source in the vessels and transfer pipes at the bottling establishment.

The general result of the attention called to the subject has been, however, a marked improvement, due to the substitution of ordinary corks and rubber stoppers by the leading manufacturers.